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09/811,581	03/20/2001	Akira Fukunaga	FUKUNAGA-3	2108

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EXAMINER

EDMONDSON, LYNNE RENEE

ART UNIT	PAPER NUMBER
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1725

DATE MAILED: 01/29/2003

10

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/811,581

Applicant(s)

FUKUNAGA ET AL.

Examiner

Lynne Edmondson

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 20 March 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-46 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-46 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All b) ☐ Some \* c) ☐ None of:  
1. ☒ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

1. Claims 1, 3, 4, 5, 7, 8, 41 and 43-46 are rejected under 35 U.S.C. 102(b) as being anticipated by Nagasawa et al. (WO 98/26889 A1) using the US equivalent (USPN 6358611) as a translation.

Nagasawa teaches a composite metallic ultrafine particle comprising a metal core surrounded by an organic compound having a functional group. The particle is formed by mixing a metallic salt, oxide or hydroxide with an organic material containing a carboxyl group and heating the mixture (col 6 lines 10-22). Fatty acid salts may be employed and metal content is from 50-90 wt% (col 2 lines 7-65). The particle size is between 1 and 100 nm (col 3 lines 11-24). The mixture is heated to a temperature above the decomposition temperature of the salt but not more than that of the organic compound (col 3 line 52 – col 4 line 15) and may contain a reducing agent (silver

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nitrate, col 5 lines 5-11). The metal is dissolved in a hydrophilic solvent (alcohol, col 4 lines 20-31). See also Nagasawa claims 1-4 and 6.

2. Claims 1-21, 41 and 43-46 are rejected under 35 U.S.C. 102(b) as being anticipated by Tomihisa et al. (USPN 5683501).

Tomihisa teaches formation of a composite metallic ultrafine particle comprising a metal core formed from a metal oxide or salt and covered with an organic compound comprising an alcoholic hydroxyl group (col 20 line 55 – col 21 line 12 and col 6 line 66 – col 7 line 15). The metal may be Ti, Si or any transition metal wherein the amount of organic material is 0.5 to 1 molecule per metal atom (col 7 lines 1-6, col 9 lines 55-65 and col 10 lines 55-67). The particle size is preferably between 5 and 100 nm (col 7 lines 40-48). The organic compound includes alcohol, acids (col 3 lines 26-36 and col 13 line 55 – col 14 line 26), amino, carboxyl or hydroxyl groups (col 6 lines 44-65 and col 18 lines 44-54). The metal salt can comprise a metal chloride, nitrate or acetate among others (col 10 lines 45-67 and col 11 line 11 – col 13 line 38) with metal present in an amount up to 99.5% (col 8 lines 4-12 and col 14 lines 27-40). The material comprises straight or branched chains (col 8 lines 54-67) and is heated under a reflux condition (col 39 lines 30-55). The mixture is heated to a temperature not greater than the decomposition temperature of the organic compound and not less than the decomposition temperature of the salt (col 7 lines 20-40). See also Tomihisa claims 1-21.

3. Claims 1-13, 15-23, 25-27, 29 and 41-46 are rejected under 35 U.S.C. 102(e) as being anticipated by Murray et al. (USPN 6262129 B1).

Murray teaches a composite metallic ultrafine particle comprising a metal core formed from a metallic salt having a diameter of up to 20 nm wherein the metal is surrounded by an organic material (col 1 lines 1-20). The metal can be any metal particle such as Au, Ag, Pt, Pd, Ni, Co, Cu and other transition metals (col 1 lines 40-67 and col 6 lines 18-32) and includes an organic group which surrounds the metal core in an amount between 0.1 and 1 molecule (col 6 lines 55-67 and figures 4, 7, 8 and 14). The organic group may be an alcoholic hydroxyl (col 3 lines 36-48), carboxyl or thiol group (col 6 line 55 – col 7 line 11). The metallic salt is an acetate (col 7 lines 53-66) or chloride (claims 13-18) which is dissolved/decomposed under reflux conditions (heating) in a hydrophilic solution (alcohol) and adding to a hydrophobic nonaqueous solvent (hydrocarbon) an organic compound and a reducing agent comprising acid (col 3 line 6 – col 4 line 28). . The solution may also contain antioxidants (oleic acid, glycol, phosphine) for enhanced stability (col 7 lines 10-52). The alcohol chain may be straight or branched (col 6 lines 55-62). See also Murray claims 1-43.

4. Claims 1-12, 22, 23, 25-27, 29 and 41-46 are rejected under 35 U.S.C. 102(e) as being anticipated by Leone et al. (USPN 6054507).

Leone teaches a composite metallic ultrafine particle comprising a metal core formed from a metallic salt having a diameter of 2 to 5 nm (col 10 lines 10-24). The metal can be any metal particle such as Ag, Au, Pd or Pt (col 11 lines 60-67) and

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includes and organic group (col 10 lines 44-68 and col 12 line 55 – col 13 line 8). The organic group may be a thiol or amine (col 11 lines 16-29) which surrounds the metal core in an amount between 0.1 and 1 molecule (col 1 lines 1-37 and col 10 line 57 – col 11 line 8). The metallic salt may be an acetate or chloride mixture which is dissolved under reflux conditions (heating, col 13 lines 1-6) in a hydrophilic solution (ethanol) and adding to a hydrophobic nonaqueous solvent (hydrocarbon) an organic compound and a reducing agent comprising an acid (col 11 lines 1-15). The solution may also contain antioxidants (additional reducing agents) for enhanced stability (col 11 lines 23-52). See also Leone claims 1, 2, 5, 12, 13 and 17-25.

5. Claims 1-29 and 41-46 are rejected under 35 U.S.C. 102(e) as being anticipated by Funaki et al. (USPN 6054507).

Funaki teaches a composite metallic ultrafine particle comprising a metal core formed from a metallic salt having a diameter of up to 10 nm col 4 lines 21-43, col 6 lines 1-13 and col 15 line 55 – col 16 line 55). The metal can be any metal particle such as Pd (col 14 lines 25-32) and includes and organic group which surrounds the metal core in an amount between 0.1 and 1 molecule (col 14 lines 25-41 and figures 1-3). The organic group may be an alcoholic hydroxyl, amine or carboxyl group (col 11 lines 5-28). The metallic salt may be a chloride mixture (col 6 lines 15-30) which is dissolved under reflux conditions (heating) in a hydrophilic solution (propyl alcohol, col 14 lines 25-41) and adding to a hydrophobic nonaqueous solvent an organic compound and a reducing agent comprising ascorbic acid. The solution may also contain antioxidants

(additional reducing agents) for enhanced stability (col 9 lines 10-16, col 10 lines 1-30 and col 14 lines 45-55). At least 50% metal is present (col 8 lines 50-59). See also Funaki claims 1-6.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 28 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leone et al. (USPN 6369206 B1).

Leone teaches a composite metallic ultrafine particle comprising a metal core formed from a metallic salt having a diameter of 2 to 5 nm (col 10 lines 10-24). The metal can be any metal particle such as Ag, Au, Pd or Pt (col 11 lines 60-67) and includes an organic group (col 10 lines 44-68 and col 12 line 55 – col 13 line 8). The organic group may be a thiol or amine (col 11 lines 16-29) which surrounds the metal core in an amount between 0.1 and 1 molecule (col 1 lines 1-37 and col 10 line 57 – col 11 line 8). The metallic salt may be an acetate or chloride mixture which is dissolved under reflux conditions (heating, col 13 lines 1-6) in a hydrophilic solution (ethanol) and adding to a hydrophobic nonaqueous solvent (hydrocarbon) an organic compound and a reducing agent comprising an acid (col 11 lines 1-15). The solution may also contain

antioxidants (additional reducing agents) for enhanced stability (col 11 lines 23-52).

Although acidic reducing agents and hydrocarbons are taught, there is no disclosure of citric acid, ascorbic acid or petroleum hydrocarbons.

It would have been obvious to one of ordinary skill in the art at the time of the invention to employ conventional reducing agents such as citric acid or ascorbic acid and to use petroleum (conventional polymer solvent) as the hydrocarbon to facilitate high-yield, cost-effective formation (Leone, col 3 lines 8-15) of a stable, organically coated metal particle using standard crosslinking technology while eliminating the usual conjugation restrictions (Leone, col 12 line 56 – col 13 line 17).

7. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Funaki et al. (USPN 6054507) in view of Mathiowitz et al. (USPN 6235224 B1).

Funaki teaches a composite metallic ultrafine particle comprising a metal core formed from a metallic salt having a diameter of up to 10 nm col 4 lines 21-43, col 6 lines 1-13 and col 15 line 55 – col 16 line 55). The metal can be any metal particle such as Pd (col 14 lines 25-32) and includes an organic group which surrounds the metal core in an amount between 0.1 and 1 molecule (col 14 lines 25-41 and figures 1-3). The organic group may be an alcoholic hydroxyl, amine or carboxyl group (col 11 lines 5-28). The metallic salt may be a chloride mixture (col 6 lines 15-30) which is dissolved under reflux conditions (heating) in a hydrophilic solution (propyl alcohol, col 14 lines 25-41) and adding to a hydrophobic nonaqueous solvent (hydrocarbon, col 9 lines 10-17) an organic compound and a reducing agent comprising ascorbic acid. The solution



may also contain antioxidants (additional reducing agents) for enhanced stability (col 9 lines 10-16, col 10 lines 1-30 and col 14 lines 45-55). At least 50% metal is present (col 8 lines 50-59). Although hydrocarbons are taught, there is no disclosure of petroleum hydrocarbons.

Mathiowitz teaches formation of an organically coated metal particle (col 4 lines 29-54 and col 6 lines 49-67) wherein the polymer solvent is a petroleum hydrocarbon (ether, col 19 lines 5-13).

It would have been obvious to one of ordinary skill in the art at the time of the invention to employ a conventional hydrocarbon solvent such as petroleum to facilitate dissolution of the polymer and introduction of metal particles into the polymer phase to form stable, ultrafine particles (Funaki, col 4 lines 15-49) with the desired microstructure and a high amount of metal (Funaki, col 7 lines 1-25).

8. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Murray et al. (USPN 6262129 B1) in view of Mathiowitz et al. (USPN 6235224 B1).

Murray teaches a composite metallic ultrafine particle comprising a metal core formed from a metallic salt having a diameter of up to 20 nm wherein the metal is surrounded by an organic material (col 1 lines 1-20). The metal can be any metal particle such as Au, Ag, Pt, Pd, Ni, Co, Cu and other transition metals (col 1 lines 40-67 and col 6 lines 18-32) and includes an organic group which surrounds the metal core in an amount between 0.1 and 1 molecule (col 6 lines 55-67 and figures 4, 7, 8 and 14). The organic group may be an alcoholic hydroxyl (col 3 lines 36-48), carboxyl or thiol

group (col 6 line 55 – col 7 line 11). The metallic salt is an acetate (col 7 lines 53-66) or chloride (claims 13-18) which is dissolved/decomposed under reflux conditions (heating) in a hydrophilic solution (alcohol) and adding to a hydrophobic nonaqueous solvent (hydrocarbon) an organic compound and a reducing agent comprising acid (col 3 line 6 – col 4 line 28). . The solution may also contain antioxidants (oleic acid, glycol, phosphine) for enhanced stability (col 7 lines 10-52). The alcohol chain may be straight or branched (col 6 lines 55-62). However, there is no disclosure of petroleum.

Mathiowitz teaches formation of an organically coated metal particle (col 4 lines 29-54 and col 6 lines 49-67) wherein the polymer solvent is a petroleum hydrocarbon (ether, col 19 lines 5-13).

It would have been obvious to one of ordinary skill in the art at the time of the invention to employ a conventional hydrocarbon solvent such as petroleum to facilitate the redispersion and reeptizing of the nanoparticles for convenient and inexpensive formation of stable, monodisperse, nanoparticles (Murray, col 3 lines 1-12) having the desired microstructure and particle size (Murray, col 1 lines 5-20 and col 6 lines 33-39) as well as high durability and corrosion resistance (Murray, col 1 lines 28-35).

9. Claims 31-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Speakman (USPN 6503831 B2) in view of Danese (USPN 6272768).

Speakman teaches a method and apparatus for forming an interconnection on a device (col 1 lines 9-25 and col 3 lines 5-23), means for movement (figure 19), a dispersion liquid supply device (1100, figure 18) for dispensing a dispersed liquid

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comprising ultrafine particles to form a thin film (col 27 lines 5-13, presumably the particles are not larger than the film formed which is up to 50 nm), heating means (col 34 lines 10-39), polishing (etching) means (col 1 lines 35-44) with a need for cleaning (col 2 lines 16-23). The method teaches provision of a substrate with a cavity (well), supplying a liquid dispersion of fine particles and heating to melt the particles, after which etching is performed to remove excess material. Film thickness is controlled and liquid is dried/evaporated (col 27 lines 6-40 and col 1 lines 45-49). However, there is no disclosure of a polishing or cleaning step. Neither are sensors disclosed.

Danese teaches a method and apparatus for forming an interconnection comprising a loading/unloading station (multistation) (col 1 lines 37-51), a dispersion liquid supply device (18A, 18B) for dispensing a dispersed liquid comprising ultrafine particles (col 1 line 66 – col 2 line 19), multiple heating means (232) and sensors (col 6 lines 49-62), polishing with cleaning means and multiple drying means (col 5 lines 31 – 65) for controlled cleaning of both sides of the substrate (col 3 lines 21-26 and col 4 lines 46-58). The apparatus comprises a sensor for measuring the substrate thickness (col 8 lines 44-67) located proximate the substrate on the holder which controls polishing parameters including liquid supply (col 6 lines 1-17 and col 11 lines 25-67). The apparatus comprises a housing (col 4 lines 46-64) wherein pressure can be controlled (col 6 lines 1-8) by increasing or decreasing (col 7 lines 24-44) to create a pressure difference between the inside and outside of the housing (col 9 lines 22-35). As shown in figures 4 and 6, the liquid may be evaporated before, during or after

application of heat. However, the ultrafine particles in the liquid are not further disclosed.

It would have been obvious to one of ordinary skill in the art at the time of the invention that polishing is an obvious variation of etching, both used to remove excess metal material. Sensors would allow accurate process control, thereby increasing the speed and accuracy of the procedure (Speakman, col 1 lines 39-55). Cleaning means and a cleaning step as part of the connection forming process would allow effective printing of the device with a high degree of processing flexibility while maintaining the critical cleanliness required for device (Speakman, col 2 lines 10-30).

### ***Response to Arguments***

10. Applicant's arguments with respect to claims 22-40 have been considered but are moot in view of the new ground(s) of rejection.

11. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., decomposition temperature) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Regarding applicant's argument that Nagasawa does not teach mixing of two distinct materials, see column 3 lines 49-51 which teaches pre-mixing of metal and organic compounds. The metal core is surrounded by an organic compound (col 3 lines 1-10).

Therefore the 102 rejection of claims 1, 3, 4, 5, 7 and 8 as anticipated by Nagasawa stands and includes new claims 41 and 43-46.

12. Regarding applicant's argument that Tomihisa does not teach a metal core of a single material, the metal material is formed from an oxide starting material (as in instant claim 1 lines 3-4) to ultimately produce an organometallic composite particle (col 3 lines 26-30) comprising the mixture and reaction of the metal and organic materials (col 8 lines 22-39). A reducing agent may be present (nitrate, col 10 lines 46-54).

Therefore the 102 rejection of claims 1-18 as anticipated by Tomihisa stands and includes claims 19-21 and new claims 41 and 43-46.

### ***Conclusion***

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Prasad et al. (USPN 5912257), Leone et al. (USPN 6369206), Das et al. (USPN 4680204, alcoholic hydroxyl nanoparticles), Unger et al. (USPN 6231834, alcoholic hydroxyl nanoparticles), Kito et al. (USPN 5328681, nanoparticles), Heath et al. (USPN 6103868, precursor) and Miller et al. (USPN 6080670, method).

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynne Edmondson whose telephone number is (703) 306-5699. The examiner can normally be reached on M-F from 7-4 with alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Dunn can be reached on (703) 308-3318. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-7118 for regular communications and (703) 305-7115 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0651.

Lynne Edmondson  
Examiner  
Art Unit 1725



1/13/02

LRE  
January 13, 2003